Fire Program Analysis – Preparedness Module
Helicopter Density Altitude

Topic: Helicopter Performance Dynamics and Density Altitude

Issue: Aircraft performance, specifically helicopters, is sensitive to changes in density altitude. Density altitude has two primary attributes, temperature and altitude.

Background: A number of FPA business rules apply to modeling Helicopters within the strategic model. Likewise, Process Change Requests (PCR) have been approved and implemented which apply to strategic modeling of helicopters.

- Business Rule: "A helicopter can be used as transportation for firefighters or as a line production fire resource, e.g. water retardant dropping, etc. but cannot be used for both at the same time."
- The current modeling has implemented PCR 7 Helicopter Crew/Drop which supports the delivery of a handcrew by a helicopter and a subsequent bucket drop operation. Therefore, the effectiveness between firefighter delivery and water drops is not analyzed as separate functions.
- The system does not model for a variable quantity helitack delivered to modeled fire events. (Reference Helitack Deployment White Paper)
- PCR 78 Aerial Drop Support Revisited. This updates PCR 4 Aerial Drop Support, and enforces the business rule; "Control line production from airtankers and helicopters is linked to the presence of supporting ground resources."
- Helicopter capability is represented by three types consistent with FPA business rule. This is a simplifying assumption for the strategic model. A proposal to implement helicopter capability by specific make and model has been deferred.

Proposed Solutions:

Three general solutions have been proposed as FPA system development has progressed through the first three releases.

1. An elevation limit was applied in previous releases. For example in lookup data set 1.2.2 a 6000 feet limitation was applied to Type 3 helicopters. Therefore, helicopters were not deployed to the modeled fire events if they were over 6000' msl. This approach was universally criticized during prototyping and initial system training.
2. PCR-064 suggested that the data combination of temperature and fire event elevation could be used to help determine helicopter performance. This data combination would have allowed the selection of the most effective helicopter as performance varied across a range of density altitudes. It relates directly to the ability to deliver Firefighters, or gallons of water. This solution required extensive lookup data development to support the two variables.

Prepared by: Steve Harbert, FPA Core Team, 208-947-3780, sharbert@blm.gov
Relates to PCR-117 Variable Helicopter Performance
For more information, see the FPA web site fpa.nifc.gov

3. Government subject matter experts (SME) in helicopter operations provided detailed performance data by elevation bands. The SMEs have prepared helicopter performance data with simplifying assumptions; for each elevation band they have assumed a single temperature value. There is no temperature variable in this most recent proposal. Therefore, PCR-064, Fire Event Temperature, is obsolete and is replaced by PCR-117 Variable Helicopter Performance.

Below 5000' Pressure Altitude &	5000' Pressure Altitude &	6000' Pressure Altitude &	7000' Pressure Altitude &	8000' Pressure Altitude &	9000' Pressure Altitude &	10000' Pressure Altitude &
All Temperatures	30 Celsius	30 Celsius	25 Celsius	25 Celsius	20 Celsius	20 Celsius

User Implications:

- The selected solution, to use elevation bands with associated temperatures will allow fire planning teams to better model their situation, relative to helicopter capability and performance.
- There is a decrease in helicopter performance as the density altitude increases for all helicopter types; this decreased delivery capacity is now input to the FPU analysis through lookup data. There is a limit at 10,000' msl., which should adequately model most, but not all situations.
- Both firefighter delivery and bucket operations are supported.
- Helicopter resources are defined as standard and limited category. The limited category has limited staffing (helicopter manager) and can only deliver water. The standard category helicopter has crew staffing, and delivers firefighters and subsequently delivers water drops.
- Ground resources are needed to support aerial drops.
- How the system will model or test a variable quantity of firefighters (helitack) is covered in the Helitack Deployment White Paper.

Supporting Documents: **FPA website**

- Helicopter_Givens_2004_7_28.pdf
- Helicopter_ExclusiveUseCrewConfiguration_2004_7_28.pdf
- AverageHelicopterData_FPAMatrix_2005_4_26.pdf

Prepared by: Steve Harbert, FPA Core Team, 208-947-3780, sharbert@blm.gov